PATENT SPECIFICATION

649,689

Date of Application and filing Complete Specification Oct. 12, 1948.

No. 26583/48.

Complete Specification Published Jan. 31, 1951.

Index at acceptance:—Class 81(ii), B9a(1 : 3a).

COMPLETE SPECIFICATION

Improvements in or relating to Inhalation Apparatus

1, WILLIAM EVAN COLLISON, a British Subject, of 87, Eccleston Square, London, S.W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to inhalation apparatus for inhaling vapour, gas or other substances for medicinal or other purposes.

Inhalation apparatus of this character heretofore have usually possessed the disadvantage of causing loss of vapour, that is, loss of particles which compose the vapour on their passage from atomizer to lungs by reason of turbulence caused by expelled air from the lungs mixing with the vapour supply and/or by disturbance in its flow as it passes along the supply tube or tubes and through inlet valve or valves and/or by an absence of a clear unobstructed passage through which the vapour particles can flow smoothly and unimpeded from atomizer to lungs and in addition, where these last conditions have been present, there has co-existed wastage of vapour during exhalation and an insufficiency of vapour supply during inhalation.

According to the present invention an inhaling apparatus is provided in which the vapour supply is brought to the nose through a valve so arranged as to be automatically and completely opened and closed by suction and pressure set up in the mouth during breathing, to which it is connected, and in which the said flow supply passes from atomizer to lungs with the minimum of turbulence and disturbance.

According to the preferred arrangement the aforesaid valve is so arranged that when the patient breathes in the valve automatically closes the tube or connection leading to the patient's mouth and opens supply tube and releases vapour for inhalation through the nose whereas when the patient breathes out, such valve automatictlly closes the vapour supply tube leading to the nose, and opens the mouth connection and permits exhalation to be effected through the mouth, the exhalation tube or passage may be provided with a one-way valve so as to permit the inhaled gas or vapour to be expelled into the outer air while preventing air from being breathed in through the outlet channel.

The apparatus may be provided with a face mask divided into two compartments adapted to fit over the patient's nose and mouth respectively, the vapour supply being connected to the nose compartment and the exhalation tube being connected to the mouth compartment.

The aforesaid valve may take the form of a ball or roller which is housed in a valve chamber and can be moved to close the supply tube and open the outlet for expelled air, or alternatively to completely open the supply tube and close the outlet, the ball or roller being rolled backwards and forwards during breathing.

Alternatively, the valve may take the form of a pivotally mouted shutter capable of assuming two positions determined by the patient's breathing, and being so shaped and arranged as to assume one position during exhalation through the mouth so as to close the vapour supply tube and open the outlet for expired air, and to automatically assume the alternative position when inhalation occurs so as to close the exhalation outlet and completely open the vapour supply tube, thus providing a clear and unobstructed passage to the nose.

The invention will be more completely understood from the following detailed description which si given in conjunction with the accompanying drawings, in which:—

Figures 1, 2 and 3 are vertical section, plan and front views respectively of one form of inhalation apparatus constructed in accordance with the invention;

Figures 4 and 5 are side section and front views respectively of a modified form of inhalation apparatus; and

Figures 6 and 7 are sectional views taken on the line A—A of Figure 4, and showing the valves in the open and closed positions respectively.

Referring now to Figures 1, 2 and 3 of these drawings, the inhaler shown comprises a face mask having two chambers separated from one another, the upper chamber 2 being for inhalation and being adapted to fit over the patient's nose, and the lower chamber 4 being for exhalation and being adapted to fit over the patient's mouth. This face mask is provided with an inhalation tube 1 which, when the inhaler is used is in a substantially upright position, and is connected at one end with the supply of vapour or gas to be administered and at the other end with the upper chamber 2 of the face mask, the upper part of this tube being bifurcated, as shown in Figure 3. A second tube or valve chamber 3 is disposed substantially at right angles to the tube 1, so that the two tubes are in communication with each other, one end of the second tube 3 being closed and the other end terminating in the lower chamber 4 of the face mask.

For the purpose of providing an unimpeded and turbulent free flow of vapour to the upper chamber 2 of the face mask, a valve consisting of a ball or roller 5 is freely mounted in the valve chamber 3 and is so shaped and arranged that when it lies across the tube 1 leading to the upper chamber 2, it arrests the flow of vapour thereto, and alternatively when rolled back it closes the mouth tube and completely opens the supply tube for an undisturbed and turbulence free flow of vapour from atomizer to lungs. (Conveniently, the tube 3 leading to the lower chamber 4 may extend a short distance beyond the tube leading to the upper chamber, as shown, so as to permit the ball or roller 5 to be centralised in position across the tube 1 leading to the upper chamber 2).

The valve chamber 3 communicates with the lower chamber of the mask 4 by means of the circular orifice or valve seating 6, and also communicates with the outer air by means of an outlet tube 7 which may be disposed parallel to the vapour supply tube 1, the points at which the exhalation and supply tubes enter the valve chamber being adjacent to each other, so that when the ball or roller 5 is moved along the valve chamber 3 leading to the lower mask chamber 4 by the suction caused by the patient's inspiration, it at once closes the exhalation passage 6 from the mouth, and also the outlet tube 7, the movement of the ball or roller towards the lower chamber 4 being limited by an annular buffer 8 preferably composed of rubber or like material which forms the walls of the exhalation outlet 6. The lower end of the outlet tube 7 is provided with a one-way valve 9 which prevents the patient from breathing in through this tube, but permits expiration to take place freely through the tube 7, when the ball valve 5 is moved away from the exhalation outlet 6.

With this arrangement it will be seen that when the patient breathes in, the ball or roller 5 will be sucked along the tube 3 leading to the lower chamber 4 so that the exhalation outlet 6 will be at once closed and inhalation through the mouth stopped, and the tube 1 for supplying vapour to the upper chamber 2 will be completely opened thus releasing an unobstructed flow of vapour to be inhaled through the nose. On the other hand, when the patient breathes out, the ball or roller 5 will be pushed back over the tube 1 leading to the face-piece 2 so as to close the latter and open the exhalation outlets so that the patient breathes out through these and not into the vapour supply, which is conserved for the next inhalation.

In the modification shown in Figures 4, 5, 6 and 7, the apparatus is provided with a mouthpiece 10, a valve chamber 14, and a vapour supply tube 11, disposed in the drawing at right angles to the valve chamber 14, the vapour for inhalation being led to a position immediately below the patient's nose by a pair of diverging tubes 12, 13 which connect with the supply tube 11 at point 20.

It is to be understood that this modification may be used with a face mask having two chambers as illustrated in Figures 1, 2 and 3, or alternatively it may be used with a nasal mask and a mouthpiece or with a mask covering the mouth only, or without any mask at all.

The supply tube 11 is connected with the mouthpiece 10 by the segmental-shaped valve chamber 14 in which is mounted a corresponding segmental-shaped shutter valve 15 which pivots on the body of the apparatus. Port or ports 22 are provided in the valve-chamber 14 for expelled breath to pass through to the outer air and are so positioned that when the segmental shutter valve 15 is in one position it covers and closes them during inhalation and uncovers and opens them in the other position during exhalation. The outlet passages or channels 22 from the valve chamber is or are terminated by a one-way valve 17 to stop any reverse currents of air entering. With this arrangement the segmental shutter valve 15 is moved into the position shown in

Figure 4 at the moment of inspiration, when the supply tube 11 is open and permits a free and unobstructed passage of vapour to pass from the supply tube 11 to the bifurcated tubes 12 and 13 and the mouthpiece 10 and the outlet port or ports and one-way valve are all closed, or when expiration occurs it is moved to the alternative position when the supply tube 11 is closed and the mouthpiece 10 and the outlet ports and the one-way valve are all open. The one-way valve or flap valve 17 is normally retained in the closed position under the action of gravity when the apparatus is held in the operative position.

With this arrangement the segmental shaped valve 15 is sucked against the end of the mouthpiece 10 when the patient breathes in, and closes it, and also closes the opening to the outlet valve 17 while the tube 11 leading to its extension and numbered 20, for supplying vapour to its bifurcated terminals 12 and 13, will be opened thus providing for nasal inhalation and preventing any breathing through the mouth.

On the other hand, when the patient breathes out, the segmental shaped valve 15 will be blown forward over the supply tube 11 and will close it, and simultaneously open the mouthpiece 10 and the passage in the valve chamber leading to the outlet valve 17.

It will be seen that with either of the arrangements described and illustrated, when the patient begins to breathe in suction created in the passage leading to the mouth will cause the valve in the vapour supply to be fully opened so as to permit the vapour to pass without turbulence or disturbance on its passage to the lungs, while as soon as the patient begins to breathe out pressure created in the said passage leading to the mouth will cause the valve in the vapour supply tube to be fully closed, thus completely closing the vapour supply tube and permitting exhalation to occur freely through the mouth. Turbulence in the vapour is thus eliminated during exhalation owing to the supply valve being completely closed and the vapour flow stopped and arrested during exhalation.

It is to be understood that the invention is not to be regarded as being in any way limited to the particular arrangement described above, since it is capable of many and varied modifications. For example, the inhaler might be arranged so that inhalation takes place through the mouth and exhalation through the nose.

Furthermore, it is to be understood that while in some cases it is preferred to employ a face-piece for effecting connection between the apparatus and the nose and mouth, as shown in Figures 1, 2 and 3, in other cases connection with the mouth may be readily established by means of a tube and the vapour or gas led to a position under or close to the nose, as shown in Figures 4, 5, 6 and 7.

It is also to be understood that the relative angular positions of the tubular parts of the apparatus may be modified to suit the particular form of construction, and that while in the arrangements illustrated the vapour supply tube has been shown at right-angles to the tube leading to the mouthpiece, this vapour supply tube may if desired be disposed at any other convenient angle as desired.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Inhalation apparatus wherein the supply of vapour is led to the patient's nose through a valve so arranged as to be automatically and completely opened to enable the patient to inhale through the nose, said valve being controlled by the suction and pressure set up in a tube leading to the patient's mouth by the alternate movement of the lugs whereby said valve is automatically opened and closed.

2. Inhalation apparatus wherein the supply of vapour is led to the patient's nose through a valve which is controlled through a connection leading to the patient's mouth in such a way that when the patient breathes in the said valve automatically closes the said connection with the mouth and opens completely the supply tube leading to the nose, and admits a turbulence free flow of vapour for inhalation through the nose, and when the patient breathes out the said valve automatically opens the said connection with the mouth and permits exhalation to be effected through the mouth and automatically closes the vapour supply tube leading to the nose.

3. Inhalation apparatus comprising a face mask having two compartments adapted to fit over the patient's nose and mouth respectively, a vapour supply tube connected to the nose compartment, an exhalation tube connected to the mouth compartment, and a valve so arranged as to be controlled by the suction and pressure set up by the patient's breathing so that when the patient breathes in said valve automatically closes the tube leading to said mouth compartment and completely opens the tube leading to said nose compartment providing an unobstructed passage for the

vapour to pass through, and when the patient breathes out said valve automatically closes the tube leading to said nose compartment and opens the tube leading to said mouth compartment.

4. Inhalation apparatus according to claim 2, wherein said vapour supply tube and said exhalation connection are connected respectively to two compartments of a face mask which are adapted to fit over the patient's nose and mouth respectively.

5. Inhalation apparatus according to Claim 2, wherein said exhalation connection is provided with an outlet valve whereby when the patient breathes out the inhaled vapour is expelled into the outer air.

6. Inhalation apparatus according to Claim 2, wherein said valve comprises a ball member which is disposed in a valve chamber so as to interrupt the flow of vapour during the exhalation period and prevent turbulence by exhaled air passing into incoming vapour, said ball member being rolled out of the path of the vapour flow, and allow turbulence free vapour to pass for inhalation by the patient, the said ball also closing the exhalation outlet.

7. Inhalation apparatus according to Claim 6, wherein the vapour supply tube is disposed substantially vertically when the apparatus is held in the operative position and terminates in a face-piece adapted to fit over the patient's nose, said exhalation connection being disposed substantially horizontally and having one end closed and the other end terminating in a mouthpiece, said ball member being automatically rolled to and fro along said horizontal tube under the action of the patient's breath so as to close the entrance to the mouthpiece during inhalation and close the vapour supply tube during exhalation.

8. Inhalation apparatus according to Claim 7, wherein said exhalation connection is also provided with an outlet tube having a one-way valve leading to the outer air so as to permit the patient to exhale freely when the vapour supply tube is closed.

9. Inhalation apparatus according to Claim 2, wherein said valve comprises a pivotally mounted shutter capable of assuming two positions determined by the patient's breathing and being so shaped and arranged as to assume one position during exhalation so as to block the vapour supply tube, said shutter being moved automatically into the other position when inhalation occurs so as to close the exhalation connection and open the vapour supply tube.

10. Inhalation apparatus according to Claim 9, wherein said vapour supply to be and said exhalation connection are disposed substantially at right-angles to one another and wherein said shutter is disposed at the connecting point of the two passages and is of substantially segmental shape in cross section perpendicular to its pivotal axis so as to be capable of being moved into the path of either expired air or incoming vapour and arresting or releasing either in response to the suction or pressure set up by the patient's breathing.

11. Inhalation apparatus according to Claim 10, wherein the said exhalation connection is arranged with a port or ports that are closed when the patient breathes in and when the shutter closes the mouthpiece and opens the vapour supply, and, alternatively, are uncovered and opened when the shutter opens the mouthpiece and closes the vapour supply.

12. Inhalation apparatus according to Claim 9, wherein said exhalation connection is provided with a pivotally mounted flap valve which is retained in the closed position during inhalation, but which is permitted to open during exhalation so as to permit the patient to breathe out into the open air.

13. Inhalation apparatus according to Claim 11, wherein said flap valve is normally retained in the closed position under the action of gravity when the apparatus is held in the operative position.

14. An improved exhalation apparatus substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 12th day of October, 1948.

MARKS & CLERK.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1951.
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[This Drawing is a reproduction of the Original on a reduced scale.]

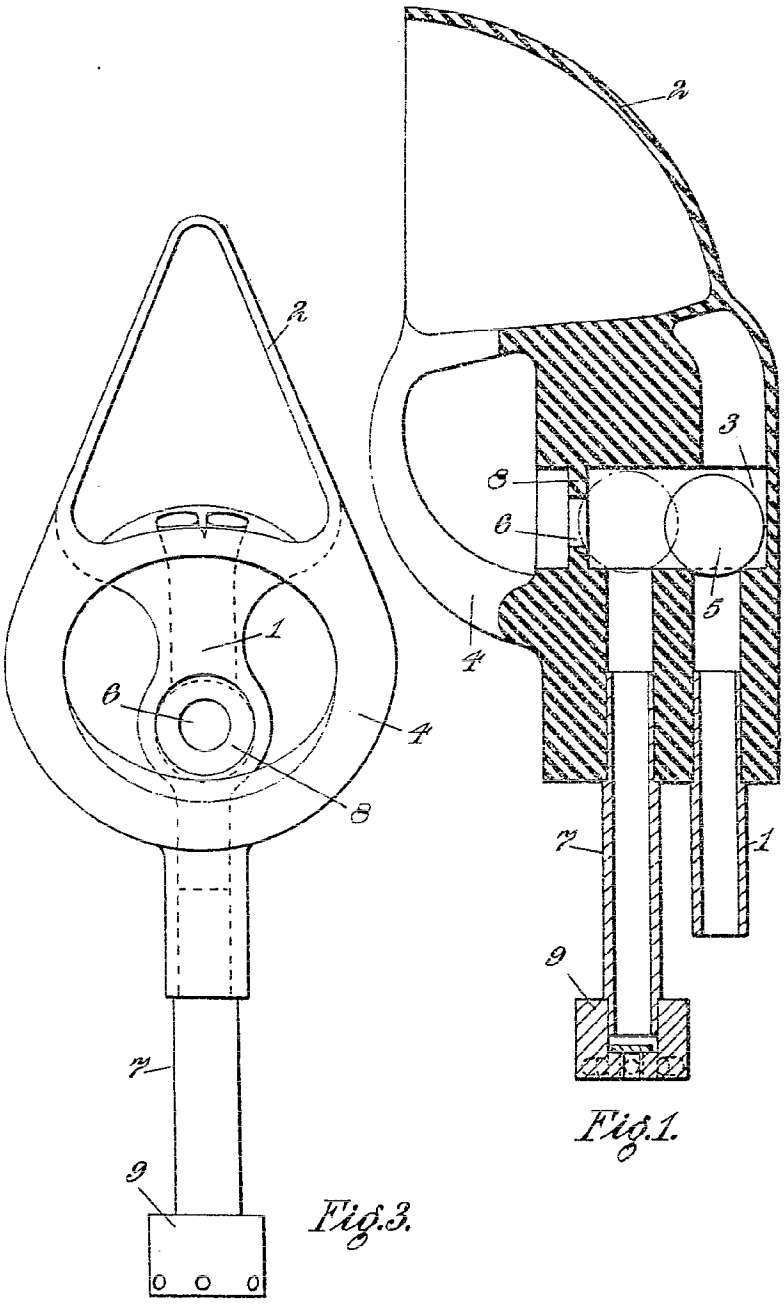

Fig. 1.

Fig. 3.

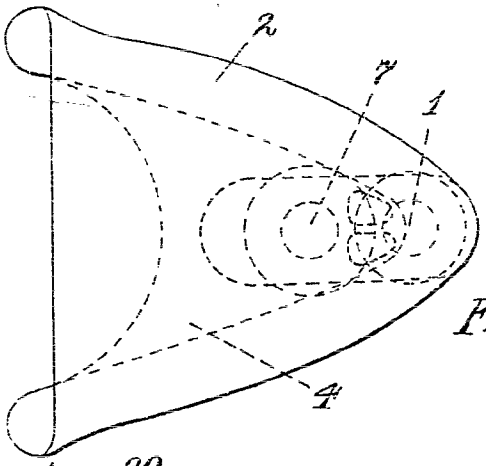

Fig. 2.

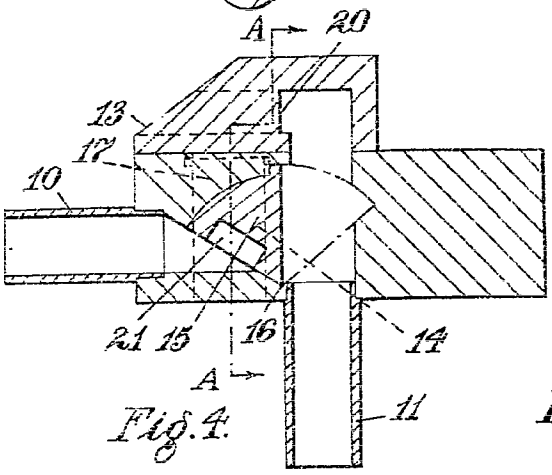

Fig. 4.

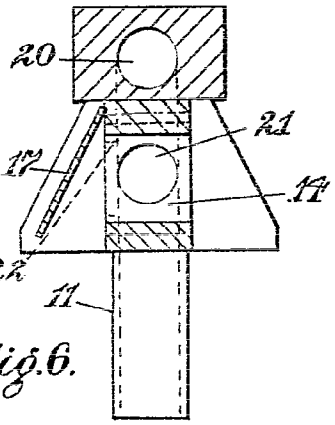

Fig. 6.

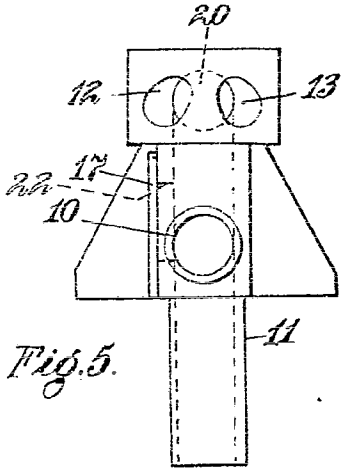

Fig. 5.

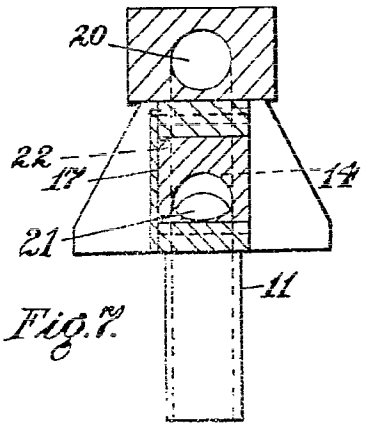

Fig. 7.

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2 SHEETS

SHEET 1

SHEET 2

[This Drawing is a reproduction of the Original on a reduced scale.]

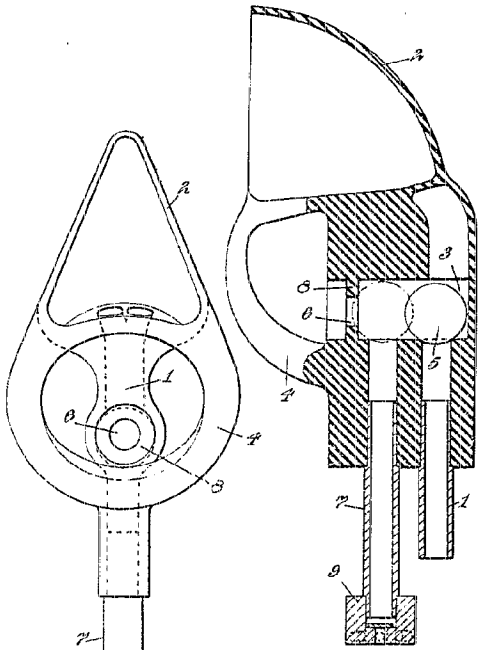

Fig. 1.

Fig. 3.

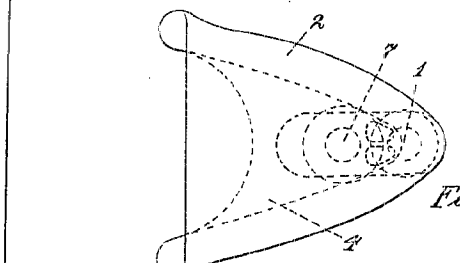

Fig. 2.

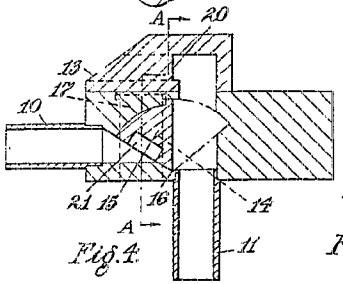

Fig. 4.

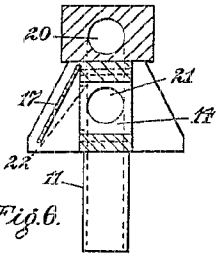

Fig. 6.

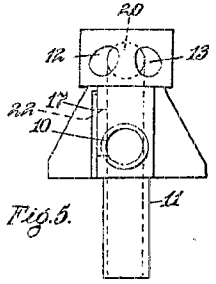

Fig. 5.

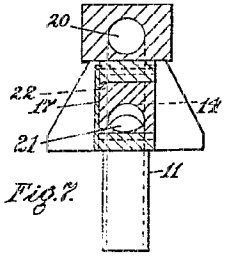

Fig. 7.

H.M.S.O. (Ty. P.)